retained in the room if the product being manufactured is not removed until its temperature is the same as the room temperature.

If power is transmitted to the machinery from the outside, then only the heat equivalent of the brake horsepower supplied is used. In the first case the Btu supplied per hour $= \dfrac{\text{Motor horsepower}}{\text{Efficiency of motor}} \times 2{,}546$, and in the second case Btu per hour = bhp. $\times$ 2,546, in which 2,546 is the Btu equivalent of 1 hp-hour. In high-powered mills this is the chief source of heating and is frequently sufficient to overheat the building even in zero weather, thus requiring cooling by ventilation the year round.

The heat (in Btu per hour) from electric lamps is obtained by multiplying the watts per lamp by the number of lamps and by 3.415. One cubic foot of producer gas gives off about 150 Btu per hour; one cubic foot of illuminating gas gives off about 535 Btu per hour, and one cubic foot of natural gas gives off about 1000 Btu per hour. A Welsbach burner averages 3 cu ft of gas per hour and a fish tail burner, 5 cu ft per hour.

The rate of heat dissipation to the atmosphere by persons depends upon the height and weight of the individuals and state of activity, and for other than moderate temperatures, it varies somewhat with the effective temperature (see Fig. 1, Chapter 28). As an engine for performing mechanical work, the human body is extremely inefficient, and hence the major part of the energy transformation within the body as determined by metabolism is dissipated as heat. Table 2, Chapter 28, gives the metabolic rates at moderate temperatures for an average size man for various degrees of activity in Btu per square foot per hour. This is the total rate of heat dissipation from the body which is divided into sensible and latent heat loss in percentages, varying widely with the temperature and humidity of the atmosphere. See Figs. 5, 6 and 7, Chapter 28.

For intermittent heating allow 10 per cent additional for rooms heated in the day time only, and for longer intervals of several days or more, add 25 per cent in determining minimum heating requirements, and size of plant.

EXAMPLES OF HEAT LOSS COMPUTATIONS

Factory Building. (See Fig. 1.)

1. LOCATION........Philadelphia, Pa.
2. LOWEST OUTSIDE TEMPERATURE. (Table 3)........ − 6 F
3. BASE TEMPERATURE:

   In this example a design temperature 10 deg F above lowest on record instead of 15 deg F is used. Hence the base temperature =

   $$(-6 + 10) = +4 \text{ deg F}.$$

4. DIRECTION OF PREVAILING WIND (during Dec., Jan., Feb.)........Northwest
5. BREATHING-LINE TEMPERATURE (5 ft from floor)........60 F

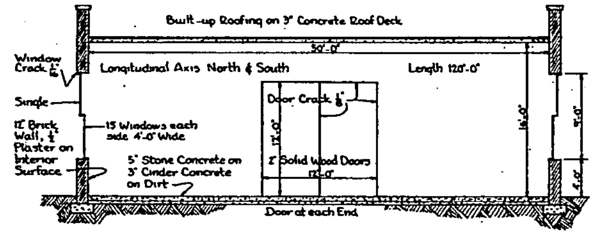

FIG. 1. ELEVATION OF FACTORY BUILDING

TABLE 4. CALCULATION SHEET SHOWING METHOD OF ESTIMATING HEAT LOSSES OF BUILDING SHOWN IN FIG. 1

Part of Building	Exposure	Width in Feet	Height in Feet	Net Surface Area or Crack Length	Coefficient	Temp. Diff.	Net Btu	Exposure Factor	Total Btu
Brick, 1/2 in. plaster	N	50	16	656	0.277	59.6	10,820	1.15	12,460
Doors (2 in. Wood)	N	12	12	144	0.382	57.2	3,150	1.15	3,620
1/8 in. Crack	N	1 pair doors		60	3.34	57.2	11,440	1/2[a] x 1.15	6,580
Brick, 1/2 in. plaster	W	120	16	1380	0.277	59.6	22,800	1.15	26,200
Glass, (Single)	W	15 x 4	9	540	1.13	60.2	36,800	1.15	42,400
1/16 in. Crack	W	Double Hung Windows (15)		450	1.67	60.2	45,200	1/2[a] x 1.15	26,000
South Wall	Same as N	See Above						1/2[a]	19,690
East Wall	Same as W	See Above						1/2[a]	82,200
Roof, 3 in. Concrete and Slag-surfaced built-up roofing.	No Ceiling	50	120	6000	0.610	69.3	254,000	None	254,000
Floor, 5 in. Stone Concrete on 3 in. Cinder Concrete.	On Dirt	50	120	6000	0.521	5	15,630	None	15,630
GRAND TOTAL of heat required for building in Btu per hour at + 4 deg with 11-mile northwest wind									488,780

[a]*Notes.*—(1) This building has no partitions and whatever air enters through the cracks on the windward side must leave through the cracks on the leeward side. Therefore, only one-half of the total crack will be used in computing infiltration for each side and each end of building.

(2) An exposure allowance of 15 per cent is also to be added to the wall and glass transmission losses and to the infiltration losses on the two adjacent sides of the building most nearly facing the prevailing wind as stated on page 17.

(3) It is also possible to compute the heat required to take care of infiltration on the basis of half of an air change per hour as given in Table 3, Chapter 4 for a factory with minimum conditions. Volume = 50 $\times$ 120 $\times$ 16 = 96,000 cu ft and heat required per hour is

$$96{,}000 \times \tfrac{1}{2} \times 0.075 \times 0.24 \times 59.6 = 51{,}500 \text{ Btu}$$

Based on infiltration through one-half the total crackage in all walls, the heat to be supplied per hour is from Table 4,

$$6{,}580 + 26{,}000 + 5{,}720 + 22{,}600 = 60{,}900 \text{ Btu}$$

The value based on crackage should be used, but if building is to be heated intermittently, not less than one air change per hour should be allowed.